

School of Pharmacy

UMKC 2007-08 Graduate and Professional Catalog (1.0)

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General Information

History

Originally organized in 1885, the school was reorganized and reincorporated in 1898 as the Kansas City College of Pharmacy and Natural Science. In 1943, this forerunner of the present school joined the University of Kansas City as its third professional school.

When the University of Kansas City was incorporated into the University of Missouri system in 1963, the School of Pharmacy became the only state-supported pharmacy school in Missouri. In October 1985, the school observed its centennial celebration, commemorating 100 years of progress in pharmaceutical education, research and service.

The School of Pharmacy is a member of the American Association of Colleges of Pharmacy (AACP). The doctor of pharmacy program is accredited by the Accreditation Council for Pharmacy Education (ACPE). The most recent accreditation review was during the 2003-04 academic year when full accreditation was continued. The next on-site accreditation review will be during the 2009-10 academic year. Anyone interested can contact ACPE at <http://www.acpe-accredit.org> for more information.

Degrees Offered

The School of Pharmacy offers programs leading to the advanced professional degree of doctor of pharmacy and the undergraduate-level bachelor of science in pharmaceutical science. Graduate-level degrees include the master of science in pharmaceutical science. Emphasis areas available in the master's degree program are:

- Pharmaceutics (including pharmaceutical technology and pharmacokinetics)
- Pharmaceutical chemistry (including medicinal chemistry),
- Pharmacology
- Toxicology

The School of Pharmacy participates in the Interdisciplinary Ph.D. program with emphasis areas in pharmaceutical science and pharmacology.

Graduate Programs

Degrees Offered

The School of Pharmacy offers the master of science in pharmaceutical science and participates in the Interdisciplinary Ph.D. degree program in the School of Graduate Studies.

Areas of concentration available at the master's level include:

- Pharmaceutics
- Pharmaceutical technology
- Biopharmaceutics/pharmacokinetics
- Medicinal chemistry
- Pharmacology
- Toxicology

The disciplines of pharmaceutical science (which incorporates pharmaceutics, pharmaceutical chemistry and pharmacokinetics) and pharmacology are eligible for Interdisciplinary Ph.D. study.

The M.S. degree incorporates research, thesis and core curricular requirements. Admission to graduate study in the School of Pharmacy represents a judgment of the faculty that a student has the potential to successfully pursue a graduate degree. It does not provide a guarantee.

Students must adhere to all stipulations of the University for the degrees sought. Nothing in this description shall be construed to be in conflict with policies of the University or the School of Graduate Studies; however, the School of Pharmacy reserves the right to set more exacting standards for admission and retention.

Admission Requirements

Master of Science in Pharmaceutical Science

All applications to master's programs in the School of Pharmacy must be made through the UMKC Admissions Office. An applicant must meet the general requirements of the University to be considered by the School of Pharmacy.

Applications are reviewed by the appropriate division and must be approved by the graduate programs committee of the school, composed of professors who have appointments to the University graduate or doctoral faculty, and by the dean of the School of Pharmacy.

Admission to the graduate programs in the School of Pharmacy is contingent on the ability of the graduate faculty to accept additional graduate students and the availability of space and funding in the proposed area of emphasis.

Thus, worthy candidates may not be accepted due to a lack of a match in students' interests to faculty availability and other considerations.

Requirements for admission to the master of science program in the School of Pharmacy include:

- A professional degree in pharmacy or a baccalaureate degree in a related-science field.
- An aggregate minimum undergraduate GPA of 3.0 for students graded on a 4.0 basis, a first-class degree for students graded on the British system or equivalent undergraduate achievement for others. (A prospective faculty adviser may require more stringent standards in the emphasis area and may recommend acceptance based on consideration of other factors.) (For those students whose emphasis area is pharmacology and toxicology, a minimum 3.5 GPA is required on all post-baccalaureate work.)
- Submission of three letters of reference bearing on the academic and research potential of the applicant from individuals who have in-depth knowledge of evaluating the applicant's ability and potential for graduate level study.

- Submission of scores obtained in the Graduate Record Examination (GRE). A minimum score of 1800 is required. (For those students whose emphasis area is pharmacology and toxicology, a minimum combined score of 1200 for the verbal and quantitative areas and the minimum score on the analytical writing portion of the GRE must be 4.5 or higher.)
- For students whose primary language is not English, scores from the Test of English as a Foreign Language (TOEFL) must be submitted. A minimum TOEFL score of 580 (paper) or 237 (computer) is required.
- Foreign students must meet financial independence criteria established by the University.
- Students whose native language is not English must follow the UMKC English Proficiency Requirements for International Students.

Although new students pursuing the pharmaceutical science emphasis are accepted during all terms, because of course sequencing, it is recommended that students enter in the fall term. The deadline for application to the M.S. program is March 1 for the fall term and Oct. 1 for application to the spring term. Due to course sequencing, new pharmacology and toxicology emphasis students will preferably be accepted in the fall term. To have credentials included in the review process, applicants should submit GRE scores and all other necessary supporting documentation no later than May 15 (domestic applicants) or March 15 (international applicants) in the year in which admission is sought.

Part-Time Graduate Students

Once all admission requirements have been satisfied, students admitted to the master of science in pharmaceutical science emphasis area or doctoral students whose coordinating unit is pharmaceutical science may enroll part time. Scientists who are employed in the Kansas City area may complete graduate study on a part-time basis by electing up to six credit hours each semester. However, the student must satisfy residency requirements and time limit restrictions of the School of Graduate Studies and the School (or its disciplines) before a degree is conferred. Research toward the thesis or dissertation must be independent of the projects ongoing at the student's place of employment. Research must be conducted in School of Pharmacy laboratories during at least two weekdays and one weekend day each week for one year.

Students whose coordinating unit or emphasis area is pharmacology and toxicology should contact the division chair for separate regulations in this area.

Doctor of Philosophy

Ph.D. programs at UMKC are interdisciplinary. Students desiring to study at the doctoral level in pharmaceutical science or pharmacology must apply to the School of Graduate Studies. Detailed information on the general and discipline-specific admission requirements may be found in the School of Graduate Studies section of this catalog.

Students pursuing Interdisciplinary Ph.D. study, who have selected pharmaceutical science or pharmacology as one of their disciplines, should consult the School of Graduate Studies section of this catalog for degree requirements and other academic regulations applicable to their degree programs.

Career Applications

The M.S. degree offers advanced education in pharmaceutical science to students with undergraduate degrees in pharmacy or baccalaureate degrees in other fields such as chemistry, chemical engineering or biology. An M.S. degree is often a requisite for management positions in industrial pharmaceuticals production, quality assurance, regulatory

affairs and other areas. It is sometimes desired as a milestone for full-time graduate students who are pursuing Interdisciplinary Ph.D. degrees, but the M.S. is not a prerequisite for the Ph.D. degree. Full-time students applying for admission to the graduate programs in the School of Pharmacy are urged to apply to the Interdisciplinary Ph.D. program.

The Ph.D. degree is the highest academic degree offered in any American university. It is a research degree. Merely attaining high grades in didactic coursework and passing examinations is insufficient demonstration of merit for this degree. Obtaining the Ph.D. degree requires demonstration of the highest order of scholarship; diligent and inventive pursuit of a research program; and defense of a dissertation based upon original research.

The Ph.D. is usually a requirement for obtaining appointment to university faculties or to senior-level appointments in research and development in pharmaceutical and related industries, research institutes and in government.

School Activities

Pharmaceutical Science Graduate Student Association (PSGSA)

Formed in 1981, this organization seeks to provide a forum for the exchange of ideas among graduate students in pharmaceutical science and to enhance appreciation of research activities among undergraduate pharmacy students. Each year PSGSA sponsors a picnic for all new and returning graduate students. They also arrange hospitality and publicity for graduate seminar programs and the annual School of Pharmacy Research Day.

Every year, the PSGSA attends the Pharmacy Graduate Student Research Meeting (PGSRM), hosted by different Midwest universities. This annual event is organized by graduate students and provides a forum for students to present their current research projects in the field of pharmaceutical sciences.

Rho Chi Pharmaceutical Honor Society

Graduate students in pharmaceutical science who meet the society's general academic criteria may be recommended for membership after completion of their first year of graduate study.

Seminar Requirement

There are two emphasis-area-specific seminar sections:

- Pharmacy 5580A is for students in pharmaceutical science.
- Pharmacy 5580C is for students in pharmacology and toxicology.

Attendance and participation in graduate seminars is required of all graduate students in the School of Pharmacy throughout their tenure in the program regardless of enrollment. Schedules and requirements vary in these sections, but at a minimum, each student usually presents one seminar during each academic year.

Faculty Advisers

All pharmacy graduate students are assigned interim faculty advisers as stated in the letter of admission. By the end of the first year, each student must have selected a permanent adviser.

For students (master's and doctoral) whose emphasis area is pharmaceutical science, if the permanent adviser chosen is not the same as the interim adviser, the student must confirm acceptance in writing by the desired permanent adviser. If a student wishes to change permanent advisers, a meeting will be held with the student and the two advisers to discuss the change. This meeting will be mediated by the division chair. If

the division chair is one of the two advisers, a third party will mediate.

If the student changes to a faculty member outside the Division of Pharmaceutical Sciences, then such student will immediately lose any financial support from the Division of Pharmaceutical Science's resources. If the student changes to another faculty member in the Division of Pharmaceutical Science, then any support from the division or school (e.g., GTA) resources will transfer with the student during the first year of graduate studies. Resources from individual professors are at the discretion of such professors.

The adviser from whom the student is transferring has the rights to all previous projects worked on by the student and all research ideas, grant proposals, etc., originating from such work. That adviser must grant permission in writing for the student to use any such material for meeting presentation, publication, patent, thesis or dissertation.

Scholarships, Awards and Financial Assistance

Teaching and Research Assistantships

School of Pharmacy assistantships are awarded on a competitive basis. Awards are generally appointments for 10 to 20 hours per week. Assistants are required to contribute to the academic program of the School of Pharmacy through laboratory assistance or in other service of academic character. Information on the current level of stipends and application for assistantships may be obtained from the Student Services Office of the School of Pharmacy. Persons receiving assistantships are expected to enroll in a minimum of six credit hours per term. In addition to their stipends, teaching and research assistants are eligible for a waiver of nonresident fees.

Judith Hemberger Graduate Scholarship

This scholarship is awarded to a female graduate student enrolled in the UMKC School of Pharmacy's Division of Pharmacology and Toxicology or Pharmaceutical Sciences, with a minimum grade-point average of 3.0. A United States citizen is preferred.

Richard D. Johnson Graduate Pharmaceutical Sciences Award

Eligible applicants must be a UMKC Pharm.D. graduate entering the Interdisciplinary Ph.D. program immediately after graduation with a high cumulative GPA. The \$2,500 stipend is awarded during the first semester of the doctoral program. Financial need is not considered. For application procedures go to .

Robert C. Lanman Graduate Pharmacology Scholarship

Pharmacology-emphasis-area students may apply for one of two scholarship options. The first option requires the M.S. or Ph.D. pharmacology applicant to possess a minimum cumulative GPA of 3.0 and proof of financial need. The applicant must be fully admitted to the degree program and have successfully completed no less than two semesters of full-time coursework. The second option is for senior-level Interdisciplinary Ph.D. students with pharmacology as their emphasis area. The applicant must possess a minimum cumulative grade-point average of 3.0 and have successfully completed written and oral comprehensive exams. With this option, funds are to be used to offset the cost of dissertation preparation and/or to attend a scientific meeting at which an abstract of the dissertation research will be presented as first author. The recipient is selected by the Division of Pharmacology and Toxicology faculty and the school's scholarship and financial aid committee.

Thomas D. Ross Memorial Graduate Scholarship

An annual cash award established in memory of Thomas D. Ross is presented to recognize the superior pursuits of a graduate student in pharmacology. Selection preference will be given to the student who is a U.S. citizen, who is a Missouri resident and who is married.

Additional Sources of Support

The American Foundation for Pharmaceutical Education (AFPE) provides fellowships to aid graduate students who have completed at least one year in a school of pharmacy. Stipends provide for educational fees, books and partial personal needs. Applications are generally due in March and students must request application forms directly from AFPE. A statement of recommendation from the dean is required.

The United States Pharmacopeia (USP) Convention offers a maximum of eight annual fellowships of up to \$12,000 to doctoral candidates for research projects related to developing or improving standards for drugs or drug products. Candidates must be endorsed by faculty serving on the USP advisory panel.

Refer to the School of Graduate Studies section of this catalog for other potential sources of financial support.

Master of Science

Degree Requirements

Prior to full admission in the School of Pharmacy, graduate students in the pharmaceutical science or pharmacology and toxicology areas will have completed coursework in calculus, organic chemistry, physical chemistry, biochemistry, microbiology, human anatomy and physiology in University departments and schools outside the School of Pharmacy, when these courses are appropriate to their interests. They may also elect advanced courses related to their areas of interest. Because many courses have prerequisites, the sequence of emphasis area courses and elective courses is determined by the academic background of each student and their research interests and requires the concurrence of the faculty adviser.

Graduate students whose emphasis area is pharmaceutical science will be given a placement examination, administered by division faculty, to assess undergraduate preparation for graduate-level study. Deficiencies existing on admission must be discussed with the interim faculty adviser during the first semester of graduate work. Course equivalency is determined by the pharmaceutical science discipline faculty on a case-by-case basis. Students are required to pass the discipline placement exams before appearing for the comprehensive exams administered by the supervisory committee.

Minimum Requirements for M.S. Degree

1. The M.S. degree requires completion of a minimum of 32 credit hours of graduate study including two credit hours of Pharmacy Seminar, three credit hours of statistics and six credit hours of Pharmacy 5599 Research and Thesis. Although students are required to enroll and successfully complete only two credit hours of Pharmacy Seminar, pharmacy graduate students (degree- and non-degree-seeking) are required to participate and attend all scheduled sessions of Pharmacy Seminar each semester.
2. Before full acceptance to a degree-seeking program, students will be selected by a faculty adviser who must be a member of the University graduate faculty. The faculty adviser and student will plan the degree program of study, contingent on approval by the supervisory committee and the graduate programs committee of the school. The faculty adviser and two additional graduate faculty members serve as the M.S. supervisory committee.

Emphasis Area Requirements

Following are the emphasis area requirements for the M.S. degree in pharmaceutical science:

Courses	Hours
Pharmaceutical Science Courses	10
Other Coursework	11
Statistics	3
PHARM 5580A Seminar	2
PHARM 5599A Research and Thesis Pharmacy	
-or-	
PHARM 5599B Research and Thesis Pharmaceutical Chemistry	6

Other graduate-level courses offered by the division or coursework in the Division of Pharmacology and Toxicology, Chemistry Department or the School of Biological Sciences may be taken with prior approval.

Following are the requirements for the M.S. degree in pharmaceutical science with emphasis in pharmacology and toxicology:

PHARM 5509 Basic Toxicology	3
PHARM 5519 Pharmacology I	4
PHARM 5520 Pharmacology II	5
PHARM 5615 Methods in Pharmacology and Toxicology	3
PHARM 5580C Seminar*	2
PHARM 5599C Research and Thesis	6
EDUC 5505 Statistical Methods I	3

A minimum of six credit hours must be chosen from the following optional courses:

PHARM 5521 Advanced Organic Medicinal Chemistry	3
PHARM 5531 Physical Pharmacy Equilibria	3
PHARM 5515 Drug Absorption, Distribution, Metabolism and Excretion	3
PHARM 5590AB Receptor Pharmacology and Signal Transduction	3

* One credit hour of Pharmacy 5580C must be successfully completed in each academic year enrolled beginning with the second year. Attendance at all seminars is mandatory regardless of enrollment.

Other graduate-level courses offered by the division or coursework in the Division of Pharmaceutical Science, Department of Chemistry or School of Biological Sciences may be taken with prior approval.

Students with professional degrees in pharmacy will be required to take other advanced graduate-level courses that are offered.

M.S. Supervisory Committee and Program of Study

This committee comprises the faculty adviser and two other graduate faculty members recommended to the School of Graduate Studies by the student and faculty adviser. The faculty adviser, who serves as chairperson of the committee, and a majority of the members of a master's student supervisory committee must be full members of the graduate faculty. Therefore, no more than one member of a master's supervisory committee may be an adjunct graduate faculty member. A majority of the faculty making up the supervisory committee must be from the student's emphasis area. An adjunct member may not be counted toward the mandated representation from the emphasis area discipline. The supervisory committee must approve the plan of study and thesis research protocol submitted by the student.

Graduate credit for courses requires that the courses be at least 300- or 400-level and that a grade of B or better be obtained. A grade lower than B in a required 5500- or

5600-level course may be allowed to stand; however, the student's adviser and supervisory committee may require that the course be repeated.

Students enroll in courses with the approval of their faculty advisers. Within the first 12 hours of degree-seeking graduate study, the student has advanced to the point where a supervisory committee is appointed and the planned program of study is developed. The program of study must receive the approval of the supervisory committee and graduate programs committee.

A majority of the coursework applicable to any graduate degree at UMKC must be completed at UMKC. See the General Graduate Academic Regulations and Information section of this catalog for more information.

Comprehensive Examination for M.S. Candidates in Pharmaceutical Science

Students are required to pass written and oral comprehensive examinations on questions provided by the supervisory committee during the semester before the degree is to be conferred. However, the oral comprehensive exam may be incorporated with the thesis defense or final project. Generally, the written examination covers knowledge which should have been obtained in performance of coursework. The oral examination encompasses knowledge which should have been obtained in performance of research, as well as coursework.

The first comprehensive examination is written. Questions are submitted by each member of the supervisory committee, as guided by the chairperson. For students with an emphasis in pharmaceutical science, the division faculty, in conjunction with the supervisory committee, will submit questions for comprehensive exams. Once the written examination has been taken, the supervisory committee must convene to determine whether the student has passed. In the event that this examination is failed, the student may retake the examination within the next semester, but no sooner than 10 weeks after the first attempt. Failure to pass the second written examination results in dropping the student from the program.

On passing the written examination, the student and his or her major adviser will schedule an oral comprehensive examination at a time mutually agreeable to the supervisory committee. The general requirements of the oral comprehensive examination will be presented to the student in writing at least six weeks in advance of the date of the examination. A determination of pass or fail on the oral examination will be made by vote of the committee after the oral examination has been completed. In the event the oral examination is failed, the student will be given a second oral examination to take place no later than the semester following the failed examination. Failure to pass the oral examination a second time will mean the candidate is dropped from the program.

More than one negative vote on an M.S. oral or written comprehensive exam constitutes failure of the examination.

A minimum of three members of the supervisory committee must be present at the oral examination for the examination to be held. If the examination is canceled for lack of the required number of examiners, it should be scheduled again as soon as possible.

M.S. candidates whose emphasis is pharmacology and toxicology are not required to take written or oral comprehensive exams. However, the supervisory committee may examine a candidate's basic pharmacology knowledge at the time of the final oral thesis defense.

Thesis Defense

The final requirement for conferral of the M.S. degree is defense of the thesis, where the supervisory committee is the

examining body. The thesis must be submitted in complete typewritten form to the adviser and supervisory committee at least six weeks before the date the advanced degree is to be conferred. See the Thesis and Dissertation Preparation and Approval Process listed under the School of Graduate Studies section of this catalog for regulations pertaining to thesis preparation. The defense is conducted only after the thesis has been certified for acceptance by the dean of the School of Graduate Studies and may not be administered when UMKC is not officially in session, nor on a weekend. The defense must be announced with an abstract at least two weeks in advance of the scheduled date of the defense.

The defense of the thesis is approved when a majority of the supervisory committee members recommend approval and sign the report of results form. Students must comply with all rules and regulations governing theses outlined under Minimum Academic Regulations Specific to Master's Degrees in the General Graduate Academic Regulations and Information section of this catalog.

Ph.D. Degree Requirements

See the Pharmaceutical Sciences or Pharmacology programs in the School of Graduate Studies catalog.

Requirements for Retention

A cumulative GPA of 3.0 (B) or better must be maintained during each semester of enrollment in all work applicable to a graduate degree.

If a student does not maintain a cumulative GPA of 3.0 (B), eligibility to continue graduate enrollment will be determined in accordance with the probation policies of the School of Graduate Studies. See the School of Graduate Studies Requirements for Retention section of this catalog. Recommendations from the School of Pharmacy will be based on evaluations by the student's supervisory committee and the school's graduate programs committee, which reviews the progress of all graduate students at the end of each semester. The student is allowed one semester to return to good academic standing.

In addition to the above requirements, master's students in pharmaceutical science with an emphasis in pharmacology and toxicology who receive a grade below B in courses offered by the Division of Pharmacology and Toxicology will be required to repeat the course. A course may not be repeated more than once, and the repeated grade achieved must be a B or higher.

A student with an emphasis in pharmacology and toxicology who receives a grade of C in more than six credit hours or who receives a grade lower than C or NC is ineligible to continue the graduate program. A C grade achieved in courses approved and offered by the Division of Pharmacology and Toxicology must be repeated.

Requirements for M.S. Degree Conferral

In addition to completing the M.S. degree requirements listed in this section, students must adhere to all requirements for the graduate degree sought and related stipulations noted in the General Graduate Academic Regulations and Information section of this catalog.

Note: Program requirements and course descriptions are subject to change without notice after publication of this catalog. Pharmacy graduate students are encouraged to remain in contact with their major faculty adviser to stay apprised of program requirements in effect.

Non-Degree-Seeking Graduate-Level Students

The School of Pharmacy recognizes that area residents employed in the pharmaceutical industry and related organizations may not desire to pursue a graduate degree, but may wish to take an occasional graduate course to update their knowledge base. Persons with baccalaureate degrees in pharmacy, chemistry or biology who have completed the appropriate prerequisite coursework for the courses they wish to undertake may request classification as 6-G non-degree-seeking graduate students. No more than 12 credit hours may be taken under a 6-G classification. Enrollment in any School of Pharmacy course requires a completed UMKC application form and approval of the director of pharmacy student affairs.

Continuing Education Programs

The School of Pharmacy is making a significant contribution to members of the pharmaceutical profession and allied health professionals by providing continuing education in pharmacy for the improvement of professional competence as it relates to drug utilization in disease states. Area needs, as they are identified by the profession, are met through conferences, short courses, home-study courses and seminars. The School of Pharmacy has been accredited as a provider of continuing education by the Accreditation Council for Pharmacy Education. For detailed information on offerings and services available, contact the associate dean.

Pharmacy (PHARM) Courses

5507 Basic Pharmacology (3). Basic pharmacological concepts and important classes of pharmacologic agents. Prerequisites: Human anatomy, physiology and biochemistry. Fall, each year.

5509 Basic Toxicology (3). Principles of general toxicology and toxicology of industrial and household chemicals, agricultural agents, social poisons, and selected therapeutic agents. Prerequisites: Human Anatomy, Physiology, Biochemistry and PHARM 507 or 519. Offered: Fall, each year.

5515 Drug Absorption, Distribution, Metabolism And Excretion (3). A course dealing with the absorption, physiologic distribution, metabolism and excretion of drugs and other organic compounds and factors which influence these events. Three hours lecture a week. Fall, odd year.

5519 Pharmacology I (4). Pharmacology of medicinals with emphasis on basic concepts, the autonomic nervous system, and cardiovascular agents. Four hours lecture per week. Prerequisite: Human anatomy, physiology and biochemistry. Offered: Fall.

5520 Pharmacology II (5). Pharmacology of medicinals with emphasis on chemotherapeutic agents, drugs acting on the renal system, and drugs for endocrine disorders. Four hours lecture per week. Prerequisite: PHARM. 519. Offered: Winter.

5521 Advanced Organic Medicinal Chemistry (3). Chemistry, physicochemical properties, mechanism of action and structure-activity relationships of organic drug molecules. Fall, odd years.

5527 Analytical Methods (3). A detailed study of the methods used to detect, identify, and quantitate drugs, small molecules, enzymes, proteins, and biological molecules. The statistical foundation, core concepts, and practical implementation of analytical methods are areas of emphasis. State-of-the-art instrumentation and recent technological developments are also presented, including biotechnology based methods such as proteomics methods and quantitative PCR. Prerequisites: Two hours of lecture and three hour demonstration/laboratory a week. Offered: Fall

5531 Physical Pharmacy Equilibria (3). Advanced principles of aqueous solutions, acid-base equilibria, solubility and complexation. Mathematical solutions and state-of-the-art research applications. Three hours lecture a week. Prerequisite: B.S. in Pharmacy Permissions of instructor. Winter, even years.

5533 Biopharmaceutics And Pharmacokinetics (4). Study of (1) the kinetics of absorption, distribution, and elimination of drugs and the relationship of kinetic parameters to dosage form, biological factors, and dosage regimen; (2) the development of various models for pharmacodynamic-pharmacokinetic correlations. Four hours lecture. Prerequisite: MATH 345 (Ordinary Differential Equations) or equivalent. Fall, even years.

5550 Stability Of Pharmaceuticals (3). The course provides instruction in the processes responsible for instability of pharmaceuticals. Course content includes, but is not limited to, instability due to light, oxygen, and metal ions; the effect of temperature on the rate of drug decomposition; the effect of dielectric constant and ionic strength on degradation; and physical and chemical instability of newer polypeptide drugs. In addition, practical strategies to prevent instability of the active compound and excipients used in pharmaceutical formulations is provided. Prerequisites: MATH Calculus (required) & Ordinary Differential Equations (recommended); Course Grade of "B" or better in both PHAR 202 and 203; Restriction: Consent of instructor Offered: Fall semester even-numbered year.

5555 Religion, Culture And Health (3). This course addresses the impact of religious beliefs on the culture practices of contemporary society, and aims at examining the relationship between these beliefs, modern sciences and health. It will be offered to all students, in Fall semesters. No prerequisites. Offered: Every Fall

5580A Seminar In Pharmaceutical Sciences (1). Enrollment and participation required of all graduate students in the School of Pharmacy during each semester of graduate study. One hour each week. This course is graded on a credit/ no credit basis. Offered: Fall and winter.

5580C Seminar In Pharmacology/Toxicology (1). Enrollment and participation required of all graduate students in the School of Pharmacy during each semester of graduate study. Credit/no credit. One hour each week. Fall & winter.

5590A Special Topics Pharmacy (1-3).

5590B Special Topics Pharmaceutical Chemistry (1-3).

5599A Research And Thesis Pharmacy (1-9).

5599B Research And Thesis Pharmaceutical Chemistry (1-9).

5599C Research And Thesis Pharmacology (1-9).

5606 Biochemical Toxicology (3). Recent advances in organ-specific toxicity and the mechanisms of toxicity of drugs and environmental chemicals. Prerequisite: Consent of instructor. Winter, odd years.

5615 Methods In Pharmacology And Toxicology (3). Exposure to some of the techniques employed in research in pharmacology and toxicology. One hour conference and six hours laboratory per week. Prerequisite: Permission of instructor.

5616 Molecular Toxicology (3). Study of the molecular mechanisms of toxicity with emphasis on receptor theory and quantitative structure activity relationships. Three hours lecture or discussion a week. Prerequisites: PHARM 510 and 515 or permission of instructor. Winter, even years.*

5625 Synthetic Medicinal Chemistry (3). Medicinal chemicals are considered as to their synthesis and structure-activity requirements as well as to current research and technology in the area. Offered on demand.*

5631 Pharmaceutical Formulations I (3). Advanced theory and practice of Pharmaceutical formulations including classical and current research. This course will introduce the principles of biomaterial based drug delivery systems and unify knowledge from the fields of biology, materials science, and pharmaceuticals. Prerequisites: B.S in Pharmacy. Offered: Fall, odd years.*

5632 Novel Drug Delivery Systems (3). The course offers up-to-date information about drug transport mechanisms and drug absorption processes across various absorptive membranes i.e., buccal, nasal, dermal, corneal, pulmonary, and oral mucosae. The course material has been designed to provide current ideas and thinking about gene delivery, drug targeting to tumor cells and lipid and carrier mediated drug delivery. It provides unique information about cell culture models as a predictor of drug delivery as well as physical chemistry of surfaces in various microparticulates and lipid emulsion systems.

5633 Receptor Pharmacology And Signal Transduction (3). Molecular characterization of drug receptors involving quantitative description of functional studies with agonists and antagonists and binding of ligands to receptors; the molecular structure of receptors and the signaling systems that couple receptors to their pharmacologic functions. Prerequisites: Biochemistry 561/562 and/or Pharmacology 519/ 520. Offered: Every other Winter Other: When we have enough students willing to take course on demand.

5645 Cancer Biotechnology I (3). This course is designed to provide a basic understanding of tumor progression, molecular events and signaling mechanisms underlying tumor formation. Epidemiological approaches, etiology, and current methods of detection and diagnosis of cancer will be discussed. Current pharmacological management strategies of cancer and future therapeutic interventions will also be reviewed. Prerequisite: BIOL 202 or equivalent. Fall, even years.

5646 Cancer Biotechnology (3). Cancer Biotechnology II will focus on gene regulation of cancer cells with specific pharmaceutical agents. The course will target chemotherapeutic agents and examine current technology in gene therapy. Antisense and ribozyme DNA will also be discussed. Prerequisites: Phar 645 and Cancer Biotechnology I. Winter, odd years.

5690B Special Topics Pharmaceutical Chemistry (1-3).

5690BB Special Topics Toxicology (1-3).

5690C Special Topics Pharmacology (1-3).

5699A Research And Dissertation - Pharmacy (1-16).

5699B Research And Dissertation Pharmaceutical Chemistry (1-16).

5699BB Research And Dissertation Toxicology (1-16).

5699C Research And Dissertation Pharmacology (1-16).

5899 Required Graduate Enrollment (1).